



UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office

NOTICE OF ALLOWANCE AND ISSUE FEE DUE

021567 MM12/0309
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SUITE 1300
601 W FIRST AVENUE
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APPLICATION NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT	DATE MAILED
09/388,826	09/01/99	046	WHIPPLE, N 2813	03/09/00
First Named Applicant	LI. 35 USC 154(b) term ext. = 0 Days.			

TITLE OF INVENTION LOW K INTERLEVEL DIELECTRIC LAYER FABRICATION METHODS

ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
0 M122-1208	438-623.000	J32	UTILITY NO		\$1210.00	06/09/00

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED.

THE ISSUE FEE MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED.

HOW TO RESPOND TO THIS NOTICE:

- I. Review the SMALL ENTITY status shown above.
If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:
- A. If the status is changed, pay twice the amount of the FEE DUE shown above and notify the Patent and Trademark Office of the change in status, or
 - B. If the status is the same, pay the FEE DUE shown above.

If the SMALL ENTITY is shown as NO:

- A. Pay FEE DUE shown above, or
- B. File verified statement of Small Entity Status before, or with, payment of 1/2 the FEE DUE shown above.

II. Part B-Issue Fee Transmittal should be completed and returned to the Patent and Trademark Office (PTO) with your ISSUE FEE. Even if the ISSUE FEE has already been paid by charge to deposit account, Part B Issue Fee Transmittal should be completed and returned. If you are charging the ISSUE FEE to your deposit account, section "4b" of Part B-Issue Fee Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give application number and batch number. Please direct all communications prior to issuance to Box ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PATENT AND TRADEMARK OFFICE COPY

Notice of Allowability

Application No.
09/388,826

Applicant(s)
Li

Examiner
Matthew Whipple

Group Art Unit
2813



All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance and Issue Fee Due or other appropriate communication will be mailed in due course.

☒ This communication is responsive to paper filed 10/18/99

☒ The allowed claim(s) is/are 1, 2, 4-14, 16-25, 34-42, and 44-51

☒ The drawings filed on Sep 1, 1999 are acceptable.

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been
☐ received.

☐ received in Application No. (Series Code/Serial Number) _____

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

A SHORTENED STATUTORY PERIOD FOR RESPONSE to comply with the requirements noted below is set to EXPIRE THREE MONTHS FROM THE "DATE MAILED" of this Office action. Failure to timely comply will result in ABANDONMENT of this application. Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

☐ Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL APPLICATION, PTO-152, which discloses that the oath or declaration is deficient. A SUBSTITUTE OATH OR DECLARATION IS REQUIRED.

☐ Applicant MUST submit NEW FORMAL DRAWINGS

☐ because the originally filed drawings were declared by applicant to be informal.

☐ including changes required by the Notice of Draftsperson's Patent Drawing Review, PTO-948, attached hereto or to Paper No. _____

☐ including changes required by the proposed drawing correction filed on _____, which has been approved by the examiner.

☐ including changes required by the attached Examiner's Amendment/Comment.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the reverse side of the drawings. The drawings should be filed as a separate paper with a transmittal letter addressed to the Official Draftsperson.

☐ Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Any response to this letter should include, in the upper right hand corner, the APPLICATION NUMBER (SERIES CODE/SERIAL NUMBER). If applicant has received a Notice of Allowance and Issue Fee Due, the ISSUE BATCH NUMBER and DATE of the NOTICE OF ALLOWANCE should also be included.

Attachment(s)

☒ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 2

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

☒ Interview Summary, PTO-413

☒ Examiner's Amendment/Comment

☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material

☒ Examiner's Statement of Reasons for Allowance

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EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Mark Matkin on 3/8/00.

2. The application has been amended as follows:

In the disclosure, at page 2, line 15, before "exemplary", replace "a" with --an--.

At the end of page 15, line 6, insert Further, forming an oxide comprising interlevel dielectric layer comprising silicon atoms bonded to both organic material and nitrogen is contemplated.

Cancel claims 3, 15, and 43. ✓

Cancel claims 26-33 and 52-64 without prejudice. ✓

Amend claim 1 as follows:

1. (Amended) A low k interlevel dielectric layer fabrication method comprising:

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CONF
A2

providing a substrate having integrated circuitry at least partially formed thereon;
forming an [oxide comprising] interlevel dielectric layer comprising [carbon] $(CH_3)_xSiO_y$
and having a dielectric constant no greater than 3.5 over said substrate; and
after forming the [carbon comprising] dielectric layer, exposing it to a plasma comprising
oxygen effective to reduce the dielectric constant to at least 15 % below what it was prior to said
exposing.

MMW 3/8/20

At claim 34, line 6, replace "carbon" with $--(CH_3)_xSiO_y--$. At claim 34, line 9, delete
"carbon comprising".

3. The following is an examiner's statement of reasons for allowance: It was not taught or
suggested in the prior art of record to expose a dielectric comprising $(CH_3)_xSiO_y$ to a plasma
comprising oxygen effective to reduce the dielectric constant to at least 15 % below what it was
prior to said exposing.

Both Rostoker (col. 11, lines 20-25) and Havemann'003 (col. 5, lines 45-50) teach
removing carbon from dielectrics to lower the dielectric constant.

Chen et al. teach employing oxygen and hydrogen plasma treatments to remove organics,
which may include methyl groups from a dielectric layer. (note that removal of organics from such
SOG films by oxygen plasma is well known to occur in the art). However, the exposure is not
taught or suggested to result in lowering the dielectric constant by at least 15%. See col. 1, lines
15-20 and col. 3, lines 17-22.

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Wang'015 teaches removing organics from $(CH_3)_xSiO_y$ by oxygen plasma. However, lowering the dielectric constant is not taught or suggested. Further, only the sides of the vias are exposed, so that the dielectric would not inherently be lowered by 15%.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Election/Restriction

4.. This application was directed to the following patentably distinct species of the claimed invention:

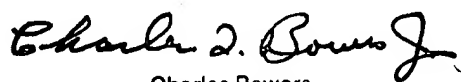
- I. Claims 1-25 and 34-51, a process of forming an oxide layer with a dielectric below 3.5
- II. Claims 26-33 and 52-64, a process of forming a nitride layer.

Group I was elected and allowed. Group II has been cancelled without prejudice.

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew Whipple whose telephone number is (703) 308-2521.

MLW

March 8, 2000



Charles Bowers
Supervisory Patent Examiner
Technology Center 2800